# SNOOPY: STUDENT NANOEXPERIMENTS FOR OUTREACH AND OBSERVATIONAL PLANETARY INQUIRY

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**Introduction: As scientists and engineers primarily employed by the public, we have a responsibility to "communicate the results of our research so that the average American could understand that NASA is an investment in our future..."[1]. Not only are we employed by the public, but they are also the source of future generations of scientists and engineers. Student Nanoexperiments for Outreach and Observational Planetary inquiry (SNOOPY) is an example of directly involving students and teachers in planetary science missions.**

## Mars Environmental Compatibility Assessment (MECA)

The MECA Student Nanoexperiment Project was a partnership between MECA, The Planetary Society (TPS) and Visionary Products, Inc. (VPI). The MECA instrument suite, developed at the Jet Propulsion Laboratory (JPL), was scheduled for launch aboard the canceled Mars Surveyor Lander 2001. The MECA Patch Plate was designed to expose various materials to the Martian environment and be observable by the Robotic Arm Camera (RAC). Students 18 years of age and younger were invited to propose experiments that were consistent with MECA's Mission: to help us better understand how humans will be able to live on Mars.

Each nanoexperiment was required to fit into single MECA Patch Plate hole, 1 cm in diameter and 1 cm deep, have a mass of 3 g or less, reauire no power, and require only a single image by the RAC. The students were asked to submit both a short proposal and a prototype of their experiment.

Sixteen entries were received from seven countries. Two nanoexperiments were chosen for flight, the Angle of Repose of Martian Dust and Contradistinctive Copper. These experiments addressed the behavior of windblown Martian dust on surfaces and the oxidation of different textures of copper. An alternate student nanoexperiment was selected to investigatethe behavior of spacesuit materials on Mars.

An important goal of this project was publication of the students' work and results in the scientific literature. One student, Lucas Möller presented the results of his Angle of Repose nanoexperiment using JSC Lunar-1 [2] and JSC Mars-1 [3] simulants at the 32nd Lunar and Planetary Science Conference [4].

## SNOOPY: Payload Integrated Education and Public Outreach

The nanoexperiments, now called SNOOPY, have been redesigned with a generic lander interface. The SNOOPY team plans to produce curricula describing how students and teachers can reproduce the nanoexperiments and perform their own calibration experiments. Should SNOOPY eventually fly, the data returned will be released to students and teachers as soon as it is released to the SNOOPY team. In the interim, the students will publish their calibration results in the scientific literature.

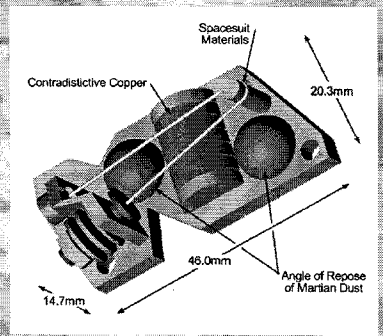
The education and public outreach goals of SNOOPY are twofold: 1) to provide opportunities for students to participate in planetary science missions and 2) to involve students worldwide in the science return and interpretation on a real-time basis. The first of these goals has been realized even though the original mission has been canceled. The second goal can be partially realized even if SNOOPY does not complete its mission. The Planetary Society and JPL plan to develop curriculum units that allow teachers and students to replicate the calibration experiments of the "student principal investigators" and to compare their results with the official calibrations. Should SNOOPY eventually fly, the images returned will be released on the World Wide Web as soon as they are made available to the investigators. Students around the world will be able to see and interpret the results and compare them to their own calibrations and to the behavior of their local materials. An online forum will allow the discussion of results.

## Lessons Learned

The SNOOPY project demonstrates the value a non-profit organization like The Planetary Society can add to planetary missions. In pursuit of their goal to disseminate knowledge about space exploration, TPS is able to cooperate with the space agencies of the world, translate scientific information into everyday language and reach into classrooms worldwide. By working with small engineering firms like VPI, hardware could be developed quickly and cheaply, without many of the constraints found in government programs.

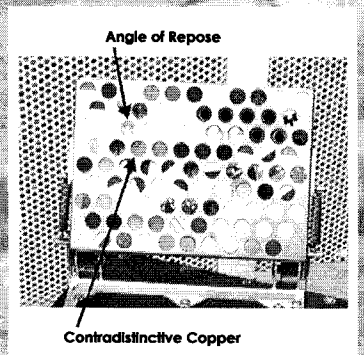
By forming a partnership between small organizations, the SNOOPY team became directly involved in education and public outreach. We had the opportunity to mentor, and hopefully inspire, the future members of our community. We recommend this approach to other projects. Create small curriculum units that time-pressed teachers can easily understand and incorporate into their lesson plans. Take the time to teach the teachers about your projects. Mentor an individual or a team of students in the NASA Student Involvement Program (more information is available at http://www.nisp.net/). Make yourself available to mentor a student who is just trying to figure out what kind of a career they want to pursue.

We have a responsibility not only to explore space, but to teach the world what we do and how we do it, to share with them what we find, and to give people worldwide a sense of ownership in our accomplishments.

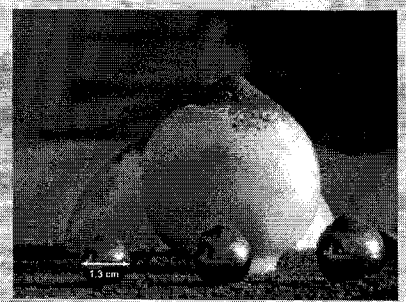



**The SNOOPY Payload incorporating the MECA Nanoexperiment, finalists and an alternate nanoexperiment.**

**Student Nanoexperiment investigator Lucas Möller discussing his instrument with scientists at the 2001 Lunar and Planetary Science Conference.**




**Student Nanoexperiments installed in the MECA Patch Plate and prepared for final integration.**




**Lucas Möller's field test of new concept for Angle of Repose nanoexperiment suggested by Martin Towner, Open University.**

## The Future of SNOOPY

The SNOOPY story does not have to end here. We invite future missions to Mars and other bodies in the Solar System to consider adding the SNOOPY concept to their payload. We hope to propose a new SNOOPY competition and payload for the "Smart Lander" currently planned by NASA for launch to Mars in 2007. This version of SNOOPY would provide power and input/output capability much like the GAS modules and Space Experiment Modules (SEM). The next SNOOPY payloads may contain tiny experiments from undergraduate and graduate students as well as researchers at large, just as the GAS modules do. This next generation of nanoexperiments can benefit from advances in microelectronics and microelectromechanical systems (MEMS). Simple or complex, they will allow more people to be directly involved in planetary science missions than ever before.

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